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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte SUDHAKAR BOBBA and TYLER THORP

Appeal 2008-4179
Application 10/033,008
Technology Center 2800

Decided: September 30, 2008

Before KENNETH W. HAIRSTON, JOHN A. JEFFERY, and BRADLEY
W. BAUMEISTER, *Administrative Patent Judges*.

BAUMEISTER, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF CASE

Appellants appeal under 35 U.S.C. § 134 (2002) from a final rejection of claims 1 to 14. Claims 15 to 18 have been withdrawn as being drawn to a non-elected invention (*See* Amendment received Jul. 26, 2004). We have jurisdiction under 35 U.S.C. § 6(b) (2002). We affirm.

A. *Appellants' invention*

Appellants' invention relates to metal interconnect lines for flip-chip packaging. Specifically, Appellants invented the inclusion of slots formed

within the top or last metal interconnect layer at a region between a plurality of via interconnects and a bump electrical/mechanical connector (Spec. 1-3).

B. The claims

The independent claims are claims 1 and 8.

Representative claim 1¹ under appeal reads as follows:

1. A bump and vias structure, comprising:
 - a metal layer;
 - a plurality of vias connecting the metal layer to another metal layer;
 - a bump mounted on the metal layer; and
 - a first slot formed in the metal layer between the vias and the bump.

C. The references and rejections

The Examiner relies on the following prior art references to show unpatentability:

Bui	US 5,689,139	Nov. 18, 1997
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Admitted Prior Art

1. Claims 1 to 14 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Bui et al.
2. Claims 1 to 14 stand rejected under 35 U.S.C. § 103(a) as obvious over Admitted Prior Art in view of Bui.

¹ Appellants argue claims 1-14 together as a group. *See* App. Br. 7-9. Accordingly, we select claim 1 as representative. *See* C.F.R. §41.37(c)(1)(vii).

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Briefs and the Answer² for their respective details. In this decision, we have considered only those arguments actually made by Appellants. Arguments which Appellants could have made but did not make in the Briefs have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

D. Findings of Fact

The record supports the following findings of fact by a preponderance of the evidence:

1. Appellants acknowledge that it was known to provide integrated circuits having overlying metal layers which, in turn, are interconnected to each other and to the chip surface by means of a plurality of “vias” or vertical electrical interconnects (Specification, ¶¶ 0001 – 0006 and Figs. 1-4b).
2. Appellants acknowledge that it was known to use flip-chip packaging wherein the integrated circuit described above is electrically and mechanically connected to a separate package by means of bumps that are formed on exposed portions—called bond pads or landing pads—of the integrated circuit’s uppermost metal layer (Specification, ¶ 0025 and Figs. 1-4c).

² We refer to (1) the Appeal Brief filed June 28, 2007; (2) the Examiner’s Answer mailed October 29, 2007; and (3) the Reply Brief filed November 28, 2007 throughout this opinion.

3. Appellants acknowledge that the “current-crowding” phenomenon was known—the phenomenon wherein non-uniform current densities form within these metal layers (Specification, ¶ 0025 and Fig. 4c).
4. Appellants acknowledge that differences in current path length along the uppermost metal layer are produced by both the shape of the bump, and also by the positions of the vias and the bump relative to the top metal layer’s current path (Specification, ¶ 0025).
5. Appellants acknowledge that these differences in current path length can lead to current crowding at the junction between the bump and the uppermost metal layer (Specification, ¶ 0025).
6. Appellants acknowledge that current crowding was typically an undesirable effect because it could lead to electro-migration induced damage to the bump and uppermost wiring layer (Specification ¶ 0026).
7. Bui discloses integrated circuits having plural overlying metallization or interconnect wiring layers. Respective wiring layers are interconnected by via plugs, and various ones of the wiring layers may have slots (*See e.g.*, Bui, Fig. 3 and col. 9, ll. 27-38).
8. Bui discloses the slots are included in the wiring layers to prevent the problem of electro-migration (Bui, col. 10, l. 66 – col. 11, l. 20).

THE ANTICIPATION REJECTION OVER BUI

We first consider the Examiner's anticipation rejection of claims 1-14 over Bui.

Appellants argue the following points: Bui fails to anticipate claim 1 because Bui only discloses interconnects having slots that are disposed between sets of via plugs. Bui nowhere discloses a "bump," much less a bump connected to the slotted interconnects (App. Br. 7-9; Reply Br. 4-10). One of ordinary skill in the art would clearly understand that "vias connect metal layers within a[n] integrated circuit..., whereas bumps are conductive deposits on a top metal layer of an integrated circuit...that are used to transmit/receive signals external to the integrated circuit." In short, "bumps" are different than "vias." (App. Br. 9).

The Examiner does not dispute that Bui only discloses interconnects having slots that are disposed between sets of via plugs. But the Examiner nonetheless asserts that Bui fully meets all recited claim limitations because the term "bump" should be given a broader interpretation than that urged by Appellants (Ans. 3-9). More specifically, the Examiner asserts that the broadest reasonable definition of "bump" is the broader dictionary definition of "relatively abrupt protuberance on a surface" (Ans. 8). And that under this interpretation, the claim language is broad enough to not only read on the bumps of applicants' definition, but also read on Bui's via structures.

A. *ISSUE*

The issue before us, then, is whether Appellants have shown that the Examiner erred in finding claim 1 anticipated by Bui. The issue turns on whether the Examiner's interpretation of the term "bump" was reasonable.

For the following reasons, we find that the Examiner's interpretation cannot be sustained.

B. PRINCIPLES OF LAW

Anticipation:

"[T]he examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability." *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). "[A]nticipation of a claim under § 102 can be found only if the prior art reference discloses every element of the claim..." *In re King*, 801 F.2d 1324, 1326 (Fed. Cir. 1986) (citing *Lindemann Maschinenfabrik GMBH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 1458 (Fed. Cir. 1984)). "[A]bsence from the reference of any claimed element negates anticipation." *Kloster Speedsteel AB v. Crucible, Inc.*, 793 F.2d 1565, 1571 (Fed. Cir 1986).

Claim Interpretation:

"During examination, the claims must be interpreted as broadly as their terms reasonably allow." *In re Am. Acad. of Sci. Tech Ctr.*, 367 F.3d 1359, 1369 (Fed. Cir. 2004). "[T]he ordinary and customary meaning of a claim term is the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, *i.e.*, as of the effective filing date of the patent application." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). It is the use of the words in the context of the written description and customarily by those skilled in the relevant art that accurately reflects both the "ordinary" and the "customary" meaning of

the terms in the claims. *Ferguson Beauregard/Logic Controls v. Mega Sys.*, 350 F.3d 1327, 1338 (Fed. Cir. 2003).

[The claims] are part of “a fully integrated written instrument,” ... consisting principally of a specification that concludes with the claims. For that reason, claims “must be read in view of the specification”.... [T]he specification “is always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term.”

Phillips, 415 F.3d at 1315 (internal citations omitted).

C. ANALYSIS

In the present case, the specification provides ample guidance and context for interpreting the term “bump.” The specification describes “vias” as holes within the dielectric material that is disposed *between adjacent metal layers* for providing conductive pathways between adjacent metal layers (Specification, ¶ 0004 and Figs. 1-7). The specification alternatively describes “bumps” as conductive structures located *on the outer surface of the uppermost metal layer* for both mechanical connection to—and for electrically transmitting/receiving signals and power to/from—external components (Specification, ¶¶ 0003 - 0004 and FIGs. 1-7).

Moreover, the specification only uses the terms, “vias” and “bumps,” in a mutually distinctive context. Contrary to the Examiner’s position, the specification contains absolutely no indication that the term “bump” was intended to extend beyond its conventionally accepted meaning in the art so as to further include internal via structures. Rather, a more reasonable interpretation of “bump” is an electrically conductive structure, potentially composed of solder, other metals or polymers, and which is located on the

integrated circuit's upper surface for providing structural support and electrical interconnection between the bond pads of the integrated circuit and those of other circuit packages or electrical components.

The Examiner argues that the plain meaning of a claim term is not limited to what is shown or disclosed in the specification (Ans. 8), and relying on excerpts from MPEP § 2111.01,³ further argues the broader dictionary definition must be employed because the Examiner is required to give a claim term its broadest reasonable interpretation (Ans. 7-8).

It is undisputed that an Examiner is to give a claim term its broadest reasonable interpretation. But this truism does not answer why a given, broader interpretation is also a reasonable one in a specific context. Even the portion of MPEP § 2111.01 cited within the Examiner's Answer includes the *Marosi* court's admonition: "[c]laims are not to be read in a vacuum, and limitations therein are to be interpreted in light of the specification in giving them their broadest reasonable interpretation." (quoting in *In re Marosi*, 710 F.2d 799 (Fed. Cir. 1983) (Ans. 8). And, as the *Phillips* court stated:

"Indiscriminate reliance on definitions found in dictionaries can often produce absurd results.... One need not arbitrarily pick and choose from the various accepted definitions of a word to decide which meaning was intended as the word is used in a given claim. The subject matter, the context, etc., will more often than not lead to the correct conclusion."

Phillips, 1415 F.3d at 1322 (internal cites omitted).

³ MPEP § 2111.01 PLAIN MEANING is indented under MPEP § 2111 CLAIM INTERPRETATION; BROADEST REASONABLE INTERPRETATION.

To summarize, intrinsic evidence of a claim term's plain meaning is generally to be given greater weight than extrinsic evidence of a dictionary definition. Appellants have provided a reasonable rationale of why their asserted interpretation is consistent with the plain meaning of "bump" as understood by one of ordinary skill in the art of semiconductor device packaging. The Examiner has not provided any evidence that the broader dictionary definition was one of the accepted usages for the term "bump" as it was used in the semiconductor packaging arts. Therefore, we are persuaded that the Examiner's interpretation of "bump" is overly broad and not reasonable. As such, we cannot sustain the anticipation rejection of claims 1-14.

THE OBVIOUSNESS REJECTION OVER BUI/APA

We now consider the Examiner's obviousness rejection of claims 1-14 over the Admitted Prior Art ("APA") in view of Bui.

The Examiner additionally rejected claims 1-14 under the alternative theory that even if the term "bump" must be interpreted so narrowly as not reading on a via structure, the claims would nonetheless be rendered obvious by the APA in view of Bui. The Examiner notes that the APA discloses all of the claimed elements except for the inclusion of the slots in the interconnect layer between the vias and the bump (Ans. 5). The Examiner further notes that Bui discloses interconnects having slots between via structures⁴ (Ans. 6). The Examiner also provides motivation for combining

⁴ The fact that the Examiner continued to refer to some of Bui's vias as "bumps" does not detract from the Examiner's underlying rationale.

Bui's slots into the APA: to "enhance the electromigration lifetime of the metal layer of [A]ppellant's admitted prior art" (Ans. 6).

Appellants argue "Bui and the AAPA (i) are not properly combinable under § 103 in the instant case, and (ii) whether considered separately or in combination, fail to disclose each and every element of claims 1-14" (App. Br. 11).

A. *ISSUE*

The issue is whether Appellants have shown reversible error by the Examiner in maintaining the rejection. *See In re Kahn*, 441 F.3d 977, 985-86 (Fed. Cir. 2006) ("On appeal to the Board, an applicant can overcome a rejection by showing insufficient evidence of *prima facie* obviousness or by rebutting the *prima facie* case with evidence of secondary indicia of nonobviousness.") (internal citation omitted).

B. *PRINCIPLES OF LAW*

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

Discussing the question of obviousness of claimed subject matter involving a combination of known elements, *KSR Int'l v. Teleflex, Inc.*, 127 S. Ct. 1727 (2007), explains:

When a work is available in one field of endeavor, design incentives and other market forces can prompt variations of it,

either in the same field or a different one. If a person of ordinary skill can implement a predictable variation, §103 likely bars its patentability. For the same reason, if a technique has been used to improve one device, and a person of ordinary skill in the art would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill. *Sakraida* [v. *AG Pro, Inc.*, 425 U.S. 273 (1976)] and *Anderson's-Black Rock, Inc. v. Pavement Salvage Co.*, 396 U.S. 57 (1969)] are illustrative—a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.

KSR, 127 S. Ct. at 1740. If the claimed subject matter cannot be fairly characterized as involving the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, a holding of obviousness can be based on a showing that “there was an apparent reason to combine the known elements in the fashion claimed.” *Id.* at 1740-41. Such a showing requires,

“‘. . . some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness’ . . . [H]owever, the analysis need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ.”

Id. at 1741 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)).

If the Examiner’s burden is met, the burden then shifts to the Appellants to overcome the *prima facie* case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. See *In re Oetiker*, 977 F.2d at 1445.

C. ANALYSIS

We find no error in the Examiner's reliance on the collective teachings of the Admitted Prior Art and Bui to arrive at the claimed invention.

We first address Appellants' second argument that Bui and the APA, "whether considered separately or in combination, fail to disclose each and every element of claims 1-14" (App. Br. 11). This argument appears to be based on the rationale that neither Bui nor the APA *individually* teaches all of the elements of claim 1 (*See* App. Br. 9). However, it is well settled that one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. *See In re Keller*, 642 F.2d 413, 425 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

Appellants also urge that Bui and the APA are not properly combinable under § 103 because there is no indication within the prior art references expressing desirability to combine the references, as required by *In re Mills*, 916 F.2d 680 (Fed. Cir. 1990) (App. Br. 9-10). This argument is not persuasive.

At the outset, we note that *KSR Int'l v. Teleflex, Inc.*, discussed in the *Principles of Law* section hereinabove, refutes Appellants' position that a finding of obviousness can only be based upon an express and specific teaching, suggestion or motivation to combine. Regardless, we need not investigate the outer boundaries of the obviousness doctrine to resolve the present issue. In the present case, an express motivation to combine Bui's slots into the APA's metal layers does, in fact, exist. As noted by the

Examiner, Bui motivates providing such slots in the APA's uppermost metal layer for the express purpose of reducing electromigration (*e.g.*, Bui, col. 10, l. 66 – col. 11, l. 20).

Appellants further argue that the “[APA] is not at all concerned with the electromigration lifetime of metal layers; instead [APA] describes current crowding at particular regions of a bump” (App. Br. 11). This argument is contrary to the plain language of Appellants’ own disclosure. The specification expressly states, “[c]urrent crowding is typically an undesirable effect because prolonged exposure to current crowding may cause [various problems] and damage to the junction between the bump (44) and the landing pad (52). In some cases, damage *caused by electro-migration* may actually result in detachment of the bump” (Specification ¶ 0026, *italics added*).

In summary, we find that the Examiner has established a *prima facie* showing of obviousness, thereby shifting the burden to Appellants to rebut this case with argument and/or evidence. Appellants have not met this burden.

DECISION

We have not sustained the Examiner's anticipation rejection with respect to all claims on appeal. We have, however, sustained the Examiner's obviousness rejection of all claims on appeal. Therefore, the Examiner's decision rejecting claims 1-14 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

Appeal 2008-4179
Application 10/033,008

AFFIRMED

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